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ORIGINAL RESEARCH

Effects of a nurse practitioner on a multidisciplinary consultation team

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Abstract

Title. Effects of a nurse practitioner on a multidisciplinary consultation team.

Aim. This paper is a report of a study to evaluate the impact on office hours capacity, patient satisfaction, quality of life and costs of including a nurse practitioner in a multidisciplinary consultation team for patients with hand problems caused by rheumatoid arthritis.

Background. Over 90% of patients with rheumatoid arthritis suffer symptoms in their hand joints and may be seriously disabled in performing daily, work or leisure activities. A recent promising development in the treatment of patients with a chronic disease is the co-ordinating and accompanying role of a nurse, such as a nurse practitioner, in a multidisciplinary treatment team.

Methods. A two successive group time-series design was adopted. The intervention group (n = 78) visited a clinic with a nurse practitioner assigned to the team during 2003–2004. The control group (n = 69) was seen before inclusion of the nurse practitioner. Office hours capacity, patient satisfaction, quality of life and costs were assessed using questionnaires directly after consulting the team, and 3 and 6 months later.

Results. Between-group comparisons of patient satisfaction and quality of life revealed no statistically significant differences. Changes within groups over time were not demonstrable. Mean office hour capacity increased by 17% (t = −1·906, d.f. = 32·879, P = 0·065). The costs for professional home care or informal care were equal in the two groups.

Conclusion. Evaluation of clinical practice using pre- and post-test design was impeded by changes in clinical practice, which made concrete conclusions difficult to draw. In future studies the satisfaction of participating clinicians should be evaluated, in addition to that of patients.

Keywords: cohort, hand, multidisciplinary consultation team, nurse practitioner, questionnaire, rheumatoid arthritis

Introduction

Over 90% of patients with rheumatoid arthritis (RA) suffer symptoms in their hand joints (Lefevre-Colau *et al.* 2001). Pain, swelling, loss of range of motion, muscle weakness and deformity lead to decreased ability to grasp and manipulate, resulting in a deterioration of hand function (Jones *et al.* 1991, Dellhag & Bjelle 1999). As a consequence, patients may be seriously disabled in performing daily, work or leisure activities (Leigh *et al.* 1992; Allaire 2001). In addition to a decrease in hand function, other physical impairments and the psychological impact of RA can cause wide-ranging problems. Therefore, holistic management has been advocated to deal with the consequences of RA: patients must be involved as partners in their care, and the physical and emotional dimensions of their disease must be recognized and addressed (Davis 2000).

A recent and promising development in the treatment of patients with chronic disease is the co-ordinating and accompanying role of a nurse, such as a nurse practitioner (NP), in a multidisciplinary treatment team (Hill *et al.* 1994, 2003, Tijhuis *et al.* 2003). It is possible that the co-ordination of rehabilitative care by a clinical nurse specialist is a useful addition to treatment delivered by teams to patients requiring integrated care (Vliet Vlieland 2003, 2004).

Study context

The multidisciplinary consultation team (MCT) for patients with hand or wrist problems caused by RA from a large university hospital in a European country organizes twice per month consultations during office hours for patients with problems in the function of the hand or wrist caused by RA. During these consultations a rheumatologist, rehabilitation physician, plastic surgeon and an occupational therapist make an inventory of patients' treatment needs and provide treatment advice. This multidisciplinary team was confronted with the following problems:

- Inadequate office hours capacity. Due to growing waiting lists, there were long waiting times for treatment, which could lead to a decline in hand function and overall quality of life (Dellhag & Bjelle 1999).
- Patient dissatisfaction. Overwhelming information in a short period of time during office hours led to dissatisfaction in patients.
- Inefficient organization of logistics. Inadequate organization of office hours and subsequent treatments was a major cause of inefficiency for the team members.

To address these problems, a NP was added to the multidisciplinary team to co-ordinate and organize the consultations, make an inventory of patient treatment needs, assess hand function and improve the quality of care provided to patients with RA who had hand problems.

The study

Aim

The aim of this study was to evaluate the impact on office hours capacity, patient satisfaction, quality of life (QoL) and costs of including a NP to a MCT for patients with hand problems caused by RA.

Design

A two successive group time-series design was adopted. Accordingly, the study began before the NP was added to the team. The control group consisted of patients who visited the clinic before the NP was added to the team. The intervention group consisted of patients who visited the MCT with the NP assigned to the team. The inclusion period was 9–10 months for both groups. The role of the NP was as follows:

- Scheduling of NP office hours before the patient was seen by the MCT. During NPs office hours, the NP gathered relevant patient information (medical correspondence, X-rays, etc.), analysed the patients' complaints about their hands or wrists and asked for their opinion on how these complaints should be treated (conservatively or surgically). In addition, the NP measured the joint mobility of wrist and fingers, grip strength, pinch grip and sensitivity of the hand using a computerized measurement system. The aim of these investigations was to support the team during office hours and improve the efficiency of the team.
- The NP was the case-manager of the patient on the clinical pathway. The NP contacted every patient by telephone a few days after the multidisciplinary team consultation to evaluate the information obtained and offer additional information if needed. If the patient agreed with the treatment proposal, which could be a conservative or a surgical procedure, the NP organized and monitored the logistics of the clinical pathway. In cases of surgical treatment, the NP co-ordinated the postoperative treatment by calling in a physical or occupational therapist from within the hospital or from outside.

- Developing referral and recording forms to improve the logistics of the clinical pathway and developing leaflets to inform patients on the various treatment options.

Participants

Any adult patient suffering hand or wrist problems due to a poly-inflammatory disease such as RA or psoriatic arthritis and visiting the MCT of a large European university hospital during a 20-month period (2003–2004) was eligible for the study. Patients were recruited at their first visit and subsequent attendances were recorded. These attendances were regarded as routine review visits. Patients who did not have a thorough command of the Dutch language were excluded from the study.

Data collection

Patient characteristics

The clinical and socio-demographic characteristics recorded at baseline were sex, age, marital status, education level, employment status, rheumatic disorder type, hand dominance and most affected hand. This data were taken from medical records and from a questionnaire which was completed at the time of consultation with the team.

Office hours capacity

The total number of patients visiting the multidisciplinary office was recorded for both groups to assess changes in the office hours capacity.

Patient satisfaction

To evaluate patient satisfaction, patients were asked to complete a questionnaire at the time of consultation (T0) and 3 (T1) and 6 months (T2) following consultation with the team. The first questionnaire was filled out at the hospital. The second and third questionnaires were sent by post and were completed at patients' homes.

The satisfaction questionnaire included items expected to improve after assigning the NP to the team. The scale, a 5-point (response) Likert scale that ranged from very satisfied to very dissatisfied, was based on one of van der Waal's studies (van der Waal *et al.* 1996). The T0 questionnaire comprised questions on waiting times, provision of information preceding the office hours and the medical advice given by the team. The T1 and T2 questionnaires specifically focused on the treatment and communication between team and patient. The psychometric properties of this adjusted satisfaction scale are not available.

Quality of life

The Michigan Hand Outcomes Questionnaire (MHQ) was used to measure hand function-related QoL. The MHQ consists of six different domains related to hand function: overall hand function, activities of daily living, pain, work performance, aesthetics and patient satisfaction with hand function. All domains are subdivided into right and left hand-specific questions, except for work performance and pain. The activities of daily living domain includes right and left hand-specific questions and a set of bilateral task questions. The raw scores for each domain are converted to normalized scores ranging from 0 to 100, where 100 indicates perfect QoL. The reliability and validity of the MHQ are good. Test–retest reliability using Spearman's correlation varied from 0·81 (aesthetics scale) to 0·97 [activities of daily living (ADL) scale] (Chung *et al.* 1998). Internal consistency evaluation revealed Cronbach's alphas ranging from 0·86 (pain) to 0·97 (ADL scale) in a study by Chung *et al.* (1998). The MHQ was mailed together with the satisfaction questionnaire.

Cost study

A cost study was conducted to collect information on economic aspects related to the assignment of the NP to the MCT. The cost study focused on various cost types within and outside the healthcare sector for both the intervention and control groups. The medical costs assessed included the costs of the consultation team and of professional home care. The non-medical costs recorded consisted of those related to informal care provided by family members or acquaintances of the patients. The costs of the consultation team were assessed by recording the time spent by the NP and other clinicians on tasks related to the consultations with hand patients. This recorded time was multiplied by the hourly wages of the various professionals concerned. Overhead costs and housing were calculated to estimate the true costs of the resources used, as recommended by international guidelines for economic studies (Drummond *et al.* 2005). In addition, patients in both groups completed regular short questionnaires on professional home care and informal care at the time of inclusion (T0) and 3 (T1) and 6 months (T2) later. At each measurement, they were asked about care received during the previous 3 months. To facilitate comparisons with other cost studies, unit prices, i.e. the price of one unit of each included cost type, were based on Dutch standard prices (Oostenbrink *et al.* 2004). The costs of informal care were estimated using 'shadow price' methodology (Brent 2006). In the present study, each hour of informal care was valued at €8. All prices were based on the value of the euro in 2004.

Ethical considerations

This study was approved by the appropriate ethics committee. Informed consent was obtained from each participant before entering the study.

Data analysis

Statistical analyses were performed using SPSS, version 14 (SPSS Inc., Chicago, IL, USA). Independent-samples *t*-tests and chi-squared tests were performed to compare the control and intervention groups on personal and hand-related variables at base line. Independent-samples *t*-tests were used to analyse differences in office hours capacity between the control and intervention groups and to analyse differences between groups of MHQ scores at T0, T1 and T2. Between-group comparisons at T0, T1 and T2 of satisfaction scores (ordinal data level) were performed using the Mann–Whitney *U*-test. Within-group changes (time effects T1, T2) were analysed for satisfaction scores using the Wilcoxon-signed ranks test. Within-group changes for MHQ scores (time effects T1, T2, T3) were analysed using repeated measures ANOVA. Longitudinal analyses of cost data were conducted by mixed model methodology. Statistical significance was set at a two-sided $P \leq 0{\cdot}05$.

Results

Patient characteristics

Seventy-one patients who visited the MCT during the study period were eligible for the control group. Of those, 69 were included in the study (97%). Seventy-eight out of 88 patients were included in the intervention group (89%). Participants did not differ from non-participants on relevant variables such as age, sex and diagnosis. The 12 patients who did not participate visited the office only once. Four of the non-participants stated that their visit being a one-off was the main reason not to complete the questionnaires. For three patients the study was too demanding, due to age or illness. Two patients argued they should not have visited the MCT at all, because the team did not have the capabilities or the facilities to treat their specific complaints. It was not possible to follow up with the remaining three patients.

Table 1 Demographic data of the control group and the intervention group

	Control group (n = 69)	Intervention group (n = 78)	Test statistic	Value (d.f.)	P value
Age (years)					
Mean (SD, range)	53·0 (12·9, 17–78)	54·1 (13·9, 17–81)	t	−0·515 (146)	0·606
Sex	n (%)	n (%)			
Male	19 (28)	26 (33)	χ^2	0·579 (1)	0·447
Female	50 (72)	52 (67)			
Hand dominance					
Right	62 (90)	62 (76)	χ^2	5·948 (2)	0·051
Left	1 (1)	9 (12)			
Both	6 (9)	7 (9)			
Most affected hand					
Right	23 (33)	29 (37)	χ^2	0·770 (2)	0·681
Left	16 (23)	20 (27)			
Both	30 (44)	28 (36)			
Diagnosis					
Rheumatoid arthritis	46 (76)	46 (59)	χ^2	2·606 (2)	0·272
Psoriatic arthritis	7 (10)	5 (6)			
Other diagnosis	16 (23)	27 (35)			
Work situation					
Working	16 (24)	24 (33)	χ^2	2·606 (4)	0·224
Disability insurance	21 (32)	13 (18)			
Housewife/husband	16 (24)	18 (25)			
Retirement	11 (17)	13 (18)			
Other	4 (3)	10 (13)			

SD, standard deviation; n, absolute number of patients; d.f., degrees of freedom.
Statistical tests used: independent-samples t-tests (age) and χ^2 tests (remaining variables).

Members of the groups did not differ statistically significantly at baseline with respect to sex, age, diagnosis, most affected hand and work situation (Table 1); only hand dominance differed (90% of control patients had right hand dominance vs. 76% in the intervention group, χ^2 = 5·948, d.f. = 2, P = 0·051).

Office hours capacity

In the control phase of the study, 86 patients were seen during 16 office hours [mean: 5·4 (SD: 1·1) patients per office hour], indicating that several patients visited the office more than once. In the intervention phase, 126 patients consulted the team during 20 office hours [mean: 6·3 (SD: 1·8) patients per office hour]. Mean office hour capacity increased by 0·9 patients per office hour (17%) (t = −1·906, d.f. = 32·879, P = 0·065).

Patient satisfaction

Although satisfaction scores were somewhat higher in the intervention group than in the control group, no statistically significant differences were found between the groups at T0, T1 and T2 (Table 2). Within-group comparisons between T1 and T2 also did not reveal statistically significant differences.

Hand-function related quality of life

Michigan Hand Outcomes Questionnaire scores were somewhat higher at T0, T1 and T2 in the intervention group compared with the control group, but the differences were not statistically significant (Table 2). Between T0 and T1, the scores on the MHQ increased for both groups. Between T1 and T2, scores on the MHQ decreased somewhat in both groups. However, these effects of time on MHQ scores were in both groups not statistically significant.

Cost study

The personnel costs of the NP during the intervention phase of the study were €30,036 (60% part-time appointment), including accommodation and overhead costs. The total costs of the tasks performed by the consultation team during the intervention phase, including those taken over by the NP, were €3388 lower than in the control phase. After subtracting these direct cost-savings from the NP personnel costs, the

Table 2 Satisfaction scores and MHQ scores

	Control group		Intervention group		Test		
Time	Mean (SD)	*n*	Mean (SD)	*n*	statistic	Value	*P* value
A. Between group comparisons – Satisfaction							
T0	4·1 (0·5)	69	4·2 (0·5)	78	M-WU	2214·5	0·061
T1	3·9 (0·8)	65	4·1 (0·5)	63	M-WU	1951·0	0·638
T2	3·9 (0·7)	53	4·1 (0·6)	63	M-WU	1477·0	0·275
						Value (d.f.)	
A. Between group comparisons – MHQ							
T0	46·7 (14·7)	68	50·5 (17·2)	78	*t*	−1·414 (144)	0·160
T1	49·3 (18·5)	68	52·8 (17·5)	73	*t*	−1·136 (139)	0·258
T2	48·8 (18·5)	60	52·0 (17·8)	70	*t*	−0·963 (127)	0·337
		Test statistic	Value	*P* value	Test statistic	Value	*P* value
B. Within group changes (time effects) – Satisfication							
Time effects (T1, T2)		*Z*	−0·097	0·923	*Z*	−0·424	0·672
		MHQ	Value (d.f.)		MHQ	Value (d.f.)	
Time effects (T0, T1, T2)		*F*	2·499 (2,58)	0·091	*F*	2·835 (2, 65)	0·066

MHQ, Michigan Hand outcomes Questionnaire; T0, directly after consultation of the team and 3 (T1) and 6 months (T2) later; SD, standard deviation; *n*, number of patients; M-WU, Mann–Whitney statistic; d.f., degrees of freedom; *Z*, *Z*-scores of Wilcoxon-signed ranks test.
Between group comparisons of satisfaction scores: Mann–Whitney *U*-test. Between group comparisons of MHQ scores: independent samples *t*-tests. Time effects between T1 and T2 of satisfaction scores: Wilcoxon signed ranks test. Time effects of MHQ-scores between T0, T1, T2: repeated measures ANOVA.

Table 3 Costs of home care and informal care in euros

	Control group				Intervention group			
	Home care		Informal care		Home care		Informal care	
Time	*n*	Mean (SD)	*n*	Mean (SD)	*n*	Mean (SD)	*n*	Mean (SD)
T0	44	395 (500)	38	458 (675)	55	140 (263)	45	272 (540)
T1	46	411 (503)	41	563 (760)	54	90 (199)	49	391 (746)
T2	41	350 (429)	36	626 (889)	66	104 (253)	62	309 (735)

SD, standard deviation; *n*, number of patients.
T0: directly after consultation of the team and 3 (T1) and 6 months (T2) later.

Table 4 Costs, ANOVA table based on mixed effect analyses

Outcome measure with model effects	d.f.	*F*	*P* value
Costs			
Model effects			
Group	1,73	1·130	0.291
Time	1,69	2·514	0.117
Baseline costs	1,72	46·298	< 0.001

Mixed effect analyses included a random effect of subject. Mixed model analyses on costs were corrected for differences at baseline by means of covariance adjustment.

mean cost of adding a NP to the MCT was €342 per patient (solely based on personnel costs).

Table 3 presents information on costs related to professional home care and informal care. The mean costs of home care and informal care were considerably higher in the control group. Within groups, there appeared to be little variation in the mean costs of home care over time. Informal care costs increased somewhat in both groups during the first 3 months. Mixed model analyses correcting for the initial discrepancies between groups (Table 4) did not reveal statistically significant differences between groups in mean total costs of home or informal care.

Study limitations

We were unable to reveal improvements in patient satisfaction or QoL. On one hand, this effect might have been absent. On the other hand, this result might be a consequence of our choice of a two successive group time-series design. A randomized clinical trial is recommended to evaluate the aftercare path. Randomization could also prevent differences at baseline in costs for professional homecare and informal care between study groups.

A second limitation of the study was that the interests of the team appeared to be of minor importance compared to the interests of patient care – during the control phase the maximum number of patients per office hour (five) was exceeded quite regularly to shorten the waiting list. Therefore, differences in the office hours capacity between the study groups were not detectable. Furthermore, the number of office hours on the basis of calculation was rather small. The statistical power would probably increase if the number of office hours were increased. Furthermore, a larger study could also focus on the number of patients instead of number of consultations, which might be a better reflection of office hours capacity.

A further limitation of the study was that we only measured satisfaction in patients. If we had also measured satisfaction in the participating clinicians, we might have had more conclusive results, as all participating clinicians were very pleased with the reduction of their workload with the help of the NP. However, as the blinding of professionals would be impossible, it would not be easy to obtain an objective opinion on the NPs activities from them. Therefore, we chose not to measure satisfaction in the participating professionals.

Discussion

Comparison of findings to those of other studies

Dutch research into multidisciplinary care for patients with RA has demonstrated that a clinical nurse specialist/NP may be a useful addition to a multidisciplinary team (Tijhuis *et al.* 2003, Vliet Vlieland 2004). In addition, a cost effectiveness and utility analysis of several treatment methods in patients with RA showed that the preferred treatment from a health-economic perspective was care provided by a clinical nurse specialist (van den Hout *et al.* 2003). Finally, an extensive review of international literature revealed that medical care according to protocol, executed by a NP, increases patient satisfaction (Knip 2005). These developments justified considering a NP for

What is already known about this topic

- A nurse practitioner can be a useful addition to a multidisciplinary team treating patients with rheumatoid arthritis as the care from the nurse practitioner is effective, safe and leads to greater control of symptoms and enhanced patient self-care.
- Care provided by a nurse practitioner according to a protocol increases patient satisfaction and is the preferred treatment from a health-economic perspective.
- Innovative forms of advanced nursing practice can enhance the effectiveness of the care process when they are embedded in a work structure that is internally consistent and adjusted to the task environment and the available skills-mix.

What this paper adds

- Adding a nurse practitioner to a multidisciplinary consultation team had no statistically significant effects on patient satisfaction and quality of life, the capacity of office hours or the costs of professional home care and informal care.
- Changes in clinical practice may lead to difficulties in obtaining evidence for improved client outcomes and cost benefit in adding a nurse practitioner to a multidisciplinary consultation team.

Implications for practice and/or policy

- A nurse practitioner added to a multidisciplinary consultation team should especially focus on patients who are in need of extensive counselling.
- When adding a nurse practitioner to a multidisciplinary consultation team, the satisfaction of participating clinicians should be evaluated, in addition to that of patients.
- Cost-savings should not be expected directly after adding a nurse practitioner to a multidisciplinary consultation team, as carrying out new tasks is accompanied by additional costs.

the role of central co-ordinator to improve the quality of care and the efficiency of our MCT for rheumatic hand problems. However, after the assignment of a NP to our team, no statistically significant differences were found between the control and intervention groups on satisfaction, office hours capacity, QoL and costs. The inconsistency in results when comparing our study to previous studies could be explained by differences in study setting. In the current study, a MCT was evaluated instead of a multidisciplinary *treatment* team, such as day care treatment or inpatient care (van den Hout *et al.* 2003, Tijhuis *et al.* 2003, Vliet Vlieland 2004, Knip 2005). Thus, the NPs role, decision-making power and, subsequently, influence on the care process in the current study were considerably less than that of previous studies.

Influences of the study design on the results

When designing the study, we foresaw that the NP would considerably change the organization of the team. Therefore, a randomized controlled trial was not regarded as feasible, as we expected that the usual care, that is the operating procedures of the team without the NP, could not be preserved after the NP had changed these. Therefore, we chose a two successive group time-series design. At pretest, care as usual was applied, and at post-test altered operating procedures were used after assignment of the NP to the team.

A disadvantage of this design was the inability to control for any confounding factors, such as the extent of involvement of the NP. Patients consulting the team received different treatments, varying from merely an explanation of the diagnosis to an operative procedure with intensive postoperative therapy. Therefore, the involvement of the NP varied from a single telephone conversation to extensive counselling before and after surgery, which probably influenced our results. This might explain why patients in the intervention group did not experience improved QoL and were not more satisfied compared with the control group, despite case management by the NP. A second possible confounding factor was that patient satisfaction is influenced by many factors over which a NP has no control, such as treatment in a ward or the waiting list for an operative procedure. For further research, we recommend the evaluation of the addition of a NP to a rheumatic hand team focusing solely on the aftercare pathway and only involving patients who will benefit from intensive counselling with the NP. In this way, a randomized controlled trial would be feasible.

Costs

Before the start of the study, it was anticipated that the introduction of a NP to the team would be accompanied by additional costs. These costs were expected to be acceptable for policy-makers in the light of the potential benefits for patients. In the current study, additional costs were partially

compensated by the NP taking over tasks from medical clinicians from the MCT. It is reasonable to expect that an NP will become more efficient the longer they are involved in the consultation team as more responsibility for more tasks from the other professionals is taken. This expectation is based on the finding that innovative forms of advanced nursing practice will enhance the effectiveness of the care process when they are embedded in a work structure that is internally consistent and adjusted to the task environment and available skill-mix. The longer an NP is active in a specific area, the better the ideal work structure that can be achieved, and the greater the impact on efficiency (van Offenbeek 2004).

As well as taking over tasks, the NP also carried out several new tasks aimed at improving the quality of care and wellbeing of patients. These new tasks could not directly lead to cost-savings but were expected to have positive consequences for other cost aspects, such as those for professional homecare or informal care. These types of costs were recorded during the study, but no relevant differences were found between groups. Unexpectedly, in analyses focusing on professional homecare and informal care we had to correct for initial differences in costs at baseline. A possible explanation for these initial costs differences is that patients in the control condition faced longer waiting lists than those in the intervention group, and therefore required more support.

Conclusion

In future studies, measurement of the effects of a NP included in a multidisciplinary team should focus on the aftercare pathway and those patients who need extensive counselling from the NP. A study design that precludes confounding factors, such as a randomized clinical trial, will then be feasible. Finally, we recommend measuring the satisfaction of participating clinicians in addition to that of patients.

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Author contributions

CS & DS were responsible for the study conception and design. LD performed the data collection. CS, LD & PD performed the data analysis. CS, LD, IS, DS & PD were responsible for the drafting of the manuscript. CS, LD, IS, ADS & PD made critical revisions to the paper for important intellectual content. CS, ADS & PD provided statistical expertise. CS obtained funding. CS, LD & IS provided administrative, technical or material support. CS & PD supervised the study.

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